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ABSTRACT

Any consideration of basic skills must at some point achieve the realization that a fundamental skill is the ability of the mind to create, produce, and utilize meaning. The purpose of productive and creative thinking is to know and understand, to produce and utilize meaning that serves to guide and direct mental and physical behavior. The overall process of thinking has been specified and designated with a large array and variety of process skills. The learner, as an information processing system, can only process that which relates to him in some way. Helping the child to make connections is helping him to operate more intelligently. The classroom is a contex for the child to improve his inquiry or process skills (e.g., sequencing, comparing, inferring) in working with and from the immediate. Teachers must help students to learn to think critically. Multiple ways of deriving teaching strategies that serve to foster the descriptive power of the learner are discussed. Included are: (1) questions teachers can ask; (2) a list of 20 principles about the processing and uses of meaning; (3) a note to parents; and (4) 43 ideas for enhancing learners' skill with productive thinking for both teacher and parent. (JMK)

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PRODUCTIVE THINKING

James Ward

Any consideration of basic skills must at some point achieve the realization that the fundamental skill is the ability of the mind to create, produce and utilize meaning. All of the basic skills serve the production and application of meaning. However, to say that there is something called productive thinking is to imply that there is something called non-productive thinking. Non-productive thinking leads nowhere. Nothing is produced. There is no product. However, productive and creative thinking proceeds through stages of formulation, from the vaguest and most inexpressible feelings of meaning, to the clearly formulated and cohered meaning, meaning that is capable of being articulated to self and others. Any and all stages of formulation are a part of the production of meaning. The purpose of productive and creative thinking, then, is to know and understand, to produce and utilize meaning that serves to guide and direct mental and physical behavior. Surely, whether the individual does the task well or poorly, effectively or ineffectively, is a direct measure of his operational intelligence at the time.

Knowing and understanding can be viewed as deriving from the mind's ability to gather and process information. Here the mind is thought of as a computer. It is an information processing system that takes in information and processes it into additional thought and meaning. We receive or take in data and use it to construct and evaluate new meaning. The additional increment, in turn, is stored as a part of the total information program of the individual's mind, ready to be retrieved, utilized, and evaluated in the

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production of still further meaning. Clearly the making of meaning is cyclic and developmental. It takes meaning to make meaning. Presumably, we can develop ever-increasing power with the task.

The overall process of thinking has been specified and designated with a large array and variety of process skills. We carry out such mental operations as describe, compare, speculate, infer, generalize. Our language contains hundreds of terms that specify kinds of thinking. Each process skill, in turn, is specified and defined by an associated vocabulary. For example, to compare carries the ideas of alike, different, analogous, similar. The learner, then, develops the concept of compare by learning the ideas of alike, different and so on. Such terms make the process of comparing operational for him. He can compare by noticing in what way things are alike and different. So, if we want to help the child learn a particular process skill, we can help him to learn its operational terms. What is it, more exactly, that we do when we speculate? When we analyze? When we hypothesize? When we sequence?

Skill with the overall process of thinking, with any process skill, requires skill with relating. The learner, as an information processing system, can only process that which relates to him in some way. That which is already there connects to the new information being processed. If there is no information already present to connect with, the new stimulus cannot be processed. This connecting and chaining effect forms relationships which give the learner the ability to think. Intelligence is contingent upon the ability to perceive, construct, and utilize relationships. Nothing can have sense apart from a context of relationships. Helping the child to make connections is helping him to operate more intelligently.

Processing requires the formulation of meaning. Meaning and information of whatever kind necessarily must be formulated and embodied in some way. Thought

must be represented in some way. What are the forms of representation that are involved in thinking? Thinking is formulated and carried by means of a variety of representations. Thought is represented in such forms as mental images or constructs, language, feelings. Representations of meaning range from the actual and three dimensional through the two dimensional and the completely abstract form, language. The learner must learn to read, to infer, to get meaning, not only from the actual, but also from more abstract representations, from a variety of graphics and from language. He must learn to produce meaning from that which is direct experience, the primary or immediate source. Too, he must learn to produce meaning from secondary or mediate sources. In either case the mind must retrieve and utilize its knowledge. The knowledge that one possesses directs, selects, and shapes any further meaning. One's store of knowledge and meaning furnishes the individual interpretive framework, a framework that is a unique orientation for knowing. It is a developmental artifact of experience.

The significance of learning by experience is obvious and would imply that sensory education is fundamental in growth with learning. We help the learner to do a better job of producing thought from sensory input. We utilize the experience model of teaching and thus help the child learn to construct experience more effectively. We educate perception, so to speak. Teaching and learning strategies based on helping the child learn from direct observation are simply requisite for the elementary school child. Learning must be rooted in the immediate. His interests and motivation are largely directed to and reside in the immediate.

In educating perception, it must be kept in mind that active perception is much more than a mechanical and passive receiving. It is reactive, dynamic, selective and consequently personal and subjective. It is, of course, a function involving the senses, and one must wonder at the marvel that is the human

sensory equipment. The senses form a person's bridge or contact with the outer world and make it possible for him to construct the world within (the self) and the world without (his version) and to interrelate the two. Presumably anything that he can do to enhance his sensory skill will enable him to receive a greater quantity and better quality of sense data. Too, a kind of perception is involved in his being able to view or to be aware of his own thought structure.

Of the senses, the senses of touch ordinarily seems to relate us most immediately to things. The individual fills his body with the sense of touch. The surface of the entire body can be thought of as a kind of grid for receiving the tactile stimuli that the mind can transform into perceptual information. Much can be done to heighten and develop the sense of touch. What are some examples of language the teacher might use to heighten the sensory awareness of her charges?

"Boys and girls you're going to be living in your skin for years. It's going to be around you for a long time."

"Fingers are special--you can hold, grasp, and feel with them."

"How does sandpaper feel when you touch it? Hey, now that you're blindfolded, what can you say about what you are touching? What do you know about it?" "Let's think of some feeling words. Describe the bark of the tree now that you have felt it. Words can help you to feel things better. Why, words can make you feel your big toe." "What would it be like to get into a bathtub filled with jello? How does mud feel between your toes?"

"I love the feel of water when I swim...cool...warm...hot...flowing..."

"The trees feel green."

The teacher should do all that he can to delight youngsters with the sense of touch and what it is about. They can discover the power and the limitations of the sense of touch. Enhancing the tactile sense, and the others as well, can sharpen and quicken the imagination of the child, can help to open up the world around him.

What characterizes the sensitive individual, the one who has sensibility? Certainly there is a relationship between good sense (referring to intelligence) and good senses and sensing (referring to use of the senses). To have good sense is to be a good and discerning receiver and constructor of perceptual information. A person of sensibility is one who is acutely sensitive to the world without. He has expanded vision; he is observant and sensitive. Further, we might wonder if one achieves feelings (empathy) by way of feeling (knowing through the tactile sense)? What is the relationship between feelings and feeling?

The sense of sight is an expanded knowing. How might teachers enhance and develop appreciation for the power that is sight?

"Children, I fill my body with the sense of touch, but I fill this whole room with my eyes. Isn't it powerful that I can sit here and know the other side of the room?" "See the mountain through the window? I can reach out and bring in the mountain with my eyes."

"Why can't I see with the bottom of my feet? What is seeing?"

"How can I check to be sure that I am seeing right?" "Boys and girls, all of your senses can help you to know what's out there. Do you suppose that you can get to know better with them? Let's observe what's going on around us.

And so the individual learns and is delighted to know that he can reach out with his senses and his mind and gather and construct a limitless amount of knowledge. There is so much there, an endless amount. The senses are feelers, extensions of the self, and through what is an essentially mysterious process the feelers of the mind are able to take in stimuli and construct an awareness, a knowing of what is out there. It's a beautiful world.

If there were another sense, what would it be and what would it be called? Glok? If something were gloked what would be revealed? What would the world be for one sighted only in the infra-red?

Perception is fascinating and is inextricably bound up with all levels and kinds of thinking. Perceptual knowledge, descriptive data, serves as raw material for any and all processing operations. Certainly all kinds of constructing and processing operations await, e.g., imagining, describing, generalizing, comparing, day-dreaming, thousands of kinds. The mind is constantly at work with its symbols, such as images and languages, formulating and focusing percepts out of sensory stimuli and then making thought and feeling constructs.

Examining the kinds of processing, such as generalizing, indicates that each kind represents a skill, a skill that the mind must learn, develop and improve. The individual is not born with the skill of constructing thought. He must develop, must learn the potential skill. He learns cognition, so to speak. Following on generalizing as an example, it could be said that it represents the high point of cognition. It's the skill. How might the skill be developed, be improved?

The teacher can help the child learn how to get from descriptive information, information that is "out there", to a thought structure that is a generalization.

Make a mind movie. Call up and reel off the mythical scene of Watt, the teakeattle, and the discovery of steampower:

> You enter the old kitchen in which there is a blazing hearthfire complete with bubbling, boiling teakeattle. Oh, it's always there anyway; you've seen it before. Besides, your mind is on something else. Your quaint kitchen is pretty well tuned out by you or you only perceive it at the blob level. Wait, something focuses your attention on the event system that is the boiling kettle. You've noticed. Now you're beginning to operate. You've noticed <u>something</u>

and something is happening. The lid jumps up and down. You wonder why. Ah, cause, the why sets you to scrutinizing relationships. First you attend, observe, focus, isolate. Next you want the cause of something. Establishing cause gets you to infer a low level generalization. "That lid will move because steam is pushing it up and down. Whenever that particular kettle is put over the fire and it boils, then its lid will jump up and down", a relatively low level of abstraction because the particulars of the scene are still involved. The next level of generalization will take you to the point of thinking that when a kettle is placed over a fire the water in it will boil and cause a loose lid to move. You have gone from the particular to the more general although you are still involved with the category of teakettles.

Most of us stay, most of the time, at a level of generalization that deals only with the particulars involved. We do not project a more abstract analogy. The more skillful, attentive, and discerning mind, however, can go on to still higher levels of abstraction. Such an individual is able to get from the categories of teakettle and fire, just exemplified, to the abstract concepts of steampower and work. He has abstracted them from the particular event system. He has cut loose from the particular. He has inferred the principle that steam is a source of power and can do work. He has moved from the most specific to the very general.

One can move up the ladder of abstraction from the more concrete to the more abstract by first of all noticing and then cohering elements of the specific instance. The elements are classified and ordered and at some point are perceived as evidence of a simple generalization. More and more abstract generalizations may be formed, each one linked to the previous and lower level

of abstraction by a common factor. Perception of a common or linking element is central to the ability to reason by analogy, that most potent of abilities for productive and creative thinking.

Events and objects are ordinarily thought of as existing at the concrete level and the specific or particular instance. This level is the manifestation level, the level from which we derive descriptive information. The occurence of natural phenomena (the explicit) can be thought of as standing for or representing natural principles, generalizations (the implicit). An infinite number of principles wait to be inferred from the world of natural events. It is to be noticed that the more abstract the generalization the more powerful it becomes, the broader its application. How wonderful it is that the mind can move from the particular to infer a generalization and then from the generalization deduce any number of specific instances or applications.

Children specifically and deliberately can be taught ever-increasing skill with generalization. They can be taught to infer the general that is represented by the specific. How might it be done? In the daily operation of the classroom the children must learn to attend, i.e., to observe and perceive more precisely; and their most powerful tool for perceiving will be skill with language, particularly descriptive language.

What would be an example of a procedure for teaching the skill of generalizing? Consider a rhythm band in a primary grade. Instead of holding his triangle by its string one boy is gripping it in his fist. He hits the triangle and it makes a leaden sound. To some the situation would be merely one of a boy holding a triangle and mis-making music. Notice, however, what could be done to help the youngsters generalize.

To begin with they must observe what happened. Next they must notice and wonder why the tone was bad. The wondering why opens the situation. As a result they might generalize about the particular triangle, then about any

triangle, and perhaps go on to an abstract principle having to do with the relationship between vibration and sound. The process will lead from a lower to a higher level of abstraction.

It is to be remembered that generalizing is only one example of hundreds of ways that the mind works with its raw material to produce increments of meaning. Further, there are at least three different kinds of generalizations. The following are examples of the three kinds:

1. England is a manufacturing nation.
2. An effect may have multiple causes.
3. Generalizations can be inferred from specific data.

The first example is of a type that rings with familiarity. It is of a kind that appears to be readily available and more closely related to the world of things. Too, it is representative of what is ordinarily thought of as subject matter.

But notice how abstract the second principle is, an effect may have multiple causes. It focuses on things, their inter-relationships and the process that moves them. It can be inferred only if the individual can observe what is happening to things and has an awareness of relationships. One must learn that things do not exist removed from their context of process and relationships.

The third kind of generalization becomes available to the individual when he can examine and reason about the very way his mind thinks, its operational skills. Too, by doing so he can come to delight in and deeply appreciate the limitless wonder that is his mind. Such principles are generalizations that can explain and predict for him. He can find great satisfaction in realizing that his mind can make knowledge, meaning, and understanding, can direct causal action.

As a person notices relationships he ordinarily thinks of cause-and-effect relationships as being the most significant. As he tries to link things up into cause and effect systems he can come to realize that he, too, is tied up into cause and effect situations. Furthermore, he can be an affector. He affects. As an affector he can influence or even determine outcome. Did he have a choice? Seeing himself as a causal agent in the world of things and process is a necessary step in seeing himself as a moral agent. He must see himself as a causal agent in order to develop a sense of self-responsibility. Further, he may come to understand that to have a reason for doing something is not the same thing as to have an excuse for doing something.

It has been pointed out that the individual receives and constructs knowledge. He also expresses and uses his knowing. He receives, constructs and expresses.

In addition to being intrinsically self-satisfying, expressing makes it possible for him to test, to evaluate his picture of what is. It is the act of communicating with the self and with the outside world. What is the message? Most importantly it tells him that he exists, establishes and expands his sense of being. How does he express? He expresses with the full powers of mind and its skills for deriving, formulating, and articulating meaning. The feedback that returns helps him to refine and add to his constructs of meaning. His experience grows. He develops. How can he be helped to express, to test, to refine his constructs?

Thus, the learner is seen as an information processing system with the school and classroom functioning as an information processing center designed to help the individual grow and develop in his ability to construct and utilize meaning.

The classroom, an information processing center, is a context for the child to improve his inquiry or process skills in working with and from the immediate. The teacher works to help the learner observe and describe and then use the observational data to reason and to think. He helps him to observe and describe, to compare and classify, to infer and generalize. The major point is that the learner needs the opportunity to learn a spectrum of process skills, all of which combined become the repertory of skills by which he can carry out productive thinking. What does he produce? For example, he produces descriptions, comparisons, conclusions, inferences, hypotheses, speculations, guesses, evaluations. He thinks and, on the basis of his thinking, acts. Strategies systematically designed to systematically teach a variety of process skills can strongly foster the development of the individual intelligence.

Again, there are numerous terms, hundreds of concepts, that designate the operations of the human mind. A partial taxonomy of such process skills include:

observing/describing
comparing/classifying
inferring/generalizing
speculating
hypothesizing
evaluating
questioning
wondering
designating
day-dreaming
organizing
sequencing
patterning
guessing
planning
altering
thin-ing
evaluating

Notice that the skills vary in level of specifity. Thinking is much more general and inclusive than is comparing. Too, the use of any one process skill will involve the use of others of the skills. Certainly, no one skill operates to the exclusion of others. Further, the cardinal rule for the teacher is that the learner must himself carry out the process skill in order to achieve the product.

The learner must himself compare in order to know the comparison. He must hypothesize in order to know the hypothesis. He must generalize in order to know the generalization.

The process skills, of course, utilize information from mediate sources as well as immediate sources. The information derived by the learner from whatever source is assimillated into his mind. From infancy the child is exposed to secondary or mediate data. He listens to language, he sees pictures and television. At some point he develops the ability to make sense of the surrounding gibberish and then for the rest of his life he is faced with the fact and necessity of deriving, utilizing, and evaluating knowledge that some mediator has constructed and made available to him. He gets information from what mama tells him. He reads a book. He watches television. He can study a picture. He can watch a play.

The learner must become functionally literate in utilizing the major symbol systems and media of his culture if he is to succeed in his culture. What a job he faces, but what sources of power and self-fulfillment. Altogether, productive and creative thinking demands skill with a variety of media that carry and express meaning. Such media not only bring meaning to us, but they also express meaning for us. I, for example, get meaning from the medium of language. I also develop, construct, express meaning with language.

So very much of the efforts of education is directed toward helping the learner become skillful with processing secondary or mediate information, and he needs all the help he can get with the critical use and evaluation of such knowledge. All of us, any teacher, would like to believe that we are promoting the growth of critical thinking on the part of the child. Again, to promote critical thinking, we work with individual process skills. Process skills apply whether we're observing a bug or reading about a bug. There are limitations in learning from experience. There are limitations in learning from books. There are certainly limitations to learning from television.

Deriving Teaching Strategies

The child is a learner. He wants to learn. During primary school age he tends to be curious about the objects and events in his immediate surroundings. He is all eyes and ears and movement. He is prime for collecting facts with his senses. Help him to use them. Whatever idea or concept you want the child to learn, try to make sure that it is rooted or can be rooted in direct experience. We realize that the pre-operational stage of mental development and the stage of concrete operations rely primarily on sensory information for the production of ideas and learning. The elementary school context, then, becomes an information processing center where the facts necessary for achieving concept goals are available from and based on observation and manipulation of actual objects and events. Secondary sources of facts, e.g., books, films, are used primarily to support and add to sensory information. Books give meaning to experience. Experience gives meaning to books.

Knowledge forms available in the mind as words and language powerfully serve to organize and synthesize the sensory field. Use words to help the child see. Language the surroundings, that which is being observed. Language not only coheres and registers the environment. It also makes operational the process skills that become the skills of inquiry for the learner.

The basic inquiry skill for the young child is that of observing and describing. The interaction between observing and describing produces and is the stuff of experience. Experience is an individual construct, an individual artifact. By means of his senses the learner encounters the immediate environment and begins to develop and to learn the concepts that become his code for making meaning. The code could be thought of as the environmental code since it is the basis by which the individual gathers and processes all sensory information.

More specifically the code enables one to carry out such operations as describing, classifying, inferring, generalizing. It happens that the code vocabulary associated with observing and describing also is used to carry out other process skills. For example, as the learner develops such concepts as color, shape, function, he has a basis not only for observing and describing things and happenings, but also for classifying them and generalizing about them. The code vocabulary that supports the describing skill becomes the basis for other process skills. As the code is extended and elaborated it becomes possible to gather and to process sensory information more effectively, to do a better job of reading or deriving meaning from the environment.

Specific and systematic consideration should be given to deriving teaching strategies that serve to foster the descriptive power of the learner. The following questions can serve as guides.

What are the attributes of description, the terms of description? We can describe in terms of physical characteristics such as color, size, form, pH. There are thousands of concepts that have been invented and that stand ready to designate physical characteristics and attributes. If we have learned the concept, then we can perceive and observe the characteristic designated by the concept. Other terms of description include those that designate function, feelings about, sequence, and others. The point for the teacher is that the child needs to practice and utilize descriptions through a variety of terms or attributes.

What is the object of description, that which is being described? What are the attributes dealing with, formulating or modifying? One can, for example, describe material objects, feelings, beliefs, happenings. A person might be skillful with describing or embodying material objects but be poor with describing moods or feelings or happenings. Notice that a concept can function either as an attribute of description or as an object of description. I can describe with red and I can describe red. It is a red ball. It is a dark red.

What is the mode of description, the form or vehicle of description? What form of representation is to be used? Description can be formulated or represented in a variety of ways. We can describe or formulate with language, with graphics, by demonstrating in action, with mathematics, with dance, with music. Here, again, variety is the keynote. What is the best mode for formulating the particular meaning? There is much meaning that cannot be formulated in language. There is a wide repertory of forms that symbolize or carry meaning. The learner needs to develop facility with a variety of forms in order to receive, construct, and express meaning efficiently and to realize the spectrum of his potential for productive and creative thought.

The teacher or parent can help the child construct and utilize descriptive information by giving him the opportunity to develop and use a variety of attributes of description, of objects of description (that which is being described), and modes of representing description. Too, help him to see purpose in description. Do I want to analyze something, tell something to others, record something for future use, enjoy something? What is it that description can do for me, for anyone? Keep in mind that descriptive information serves as the raw material for all other process skills. I must first embody something before I can compare it or speculate about it, reason with it or from it.

Other thinking skills can be analyzed in order to get a vocabulary that will cue or make operational the particular skill. To sequence might use such terms as before-after, here-there, first-second-third... . Teaching can be benefited by systematically utilizing not only a content vocabulary but also a process vocabulary. The topic of erosion, carries such subsidiary and associated concepts as solvent, dissolving, wearing, weathering, force, surface, flow, weather. To get and use facts about erosion, to make ideas about and to understand erosion carries associated concepts of processing, e.g., observing/describing, comparing/

classifying, inferring/generalizing. To know erosion, I must know how to find out about erosion.

Another highly significant process skill is planning. Volition and will, their development, are central in the cognitive skill of planning. Interest, violition and will carry the individual forward to inquire, to produce, to evaluate and decide, to make choices, to refine, to solve and resolve problems, to improve. A syntax of action is established from a syntax of thought. A self-disciplined individual with a disciplined mind can be the result. To promote the development of constructive will, help the learner organize his thinking, plan, carry out and analyze classroom activities and events around such varied paradigms of volition as "I can..., I believe that..., I am ..., I am going to..., I should..., I must..., I must first..., I need... in order to ..., I may be able to..., I know that..., Another way to do it is..., I want to..., I hope to..., I am trying to...". Each paradigm could be extended to help the learner come to recognize how the language of his thinking can direct his activities toward achieving goals and objectives.

Notice and contrast the shift in the meaning and the intent and the activity of planning and doing that would follow from the uses of different paradigms that affect volition. For example, notice the differences among:

- I might draw a picture.
- I can draw a picture.
- I want to draw a picture.
- I believe that I can draw a picture.
- I wish that I could draw a picture.
- I could draw a picture if... .
- I am going to draw a picture.
- I am going to learn to draw a picture.
- I can't draw a picture.

In the act of formulating the internal images and language of our behavior (past, present, and future) we orient our chances for successful behavior. Attitudes toward tasks are forged. We cast our approach to inquiry.

Extensions of two paradigms of volition, "I can..." and "I believe that...":

I can (fill in as appropriate):

- do it, do it if
- sing, count to ten, draw a picture
- enjoy, be happy, laugh, play, dance, swim
- tell the history of my home town
- name lots of things in my surroundings
- improve my surroundings by doing
- predict trouble coming if
- get help if I don't know what to do
- judge the validity of data by doing
- tell whether it's right or wrong, good or bad
- get it from, make it from, do it if...
- judge what's more important
- tell which is better
- see the invisible
- read questions from anything
- help others, enjoy others, work together
- see it as related to
- make mistakes, begin again, make a difference
- fail, fail temporarily, keep trying
- improve, get better
- find out, find answers, think
- recognize my fears and worries

I believe that:

- I can make a difference
- we all stand together
- short term solutions can be harmful
- we can never know everything about anything
- finding out is fun, knowing is fun
- problems can be solved if
- there may be alternative solutions
- earth is the mother of all life
- I have a mind and can learn how to use it
- I have a body and can learn how to take care of it and enjoy it
- the unknown is fascinating
- waste is harmful
- everybody sees things differently
- I have limited knowledge, everybody does
- facts are useful
- life wants to exist

Understanding principles about the processing and uses of meaning can be very powerful for guiding and promoting productive thinking. Such principles include:

1. Information is derived from immediate and mediate sources. The teacher works to help the learner become more sophisticated in the gathering, constructing, and expressing of meaning based on information that is derived from both sources. Immediate or perceptual information derives from skill with observing and describing actual phenomena. Such an emphasis is often designated as the experience model of instruction.

Skill with processing information from secondary or mediate sources assumes that the learner understands the nature of authority. Is the information from the radio or television coarect or valid? How do I judge and evaluate the validity of

the information that comes from "authority"? Can I recognize fallacious reasoning? Can I distinguish between fact and opinion?

2. The knowledge and meaning that one brings to a system, to any object or event, to any idea, determines what one perceives and understands. We perceive and think and understand in terms of what we know.

We must come to understand the basic limitations and qualifications of our own individual knowing and perceiving. As the learner constructs new meaning, based on information from either immediate or mediate sources, he is necessarily oriented and limited by the meaning that is already programmed into his mind. He is necessarily limited by the uniqueness of his mind. He also possesses the power that is his individual mind. In all the world, there never has been nor never will be a mind that is commensurate.

3. There are many terms of description that can be used in observing anything. Perceiving and observing, observing and describing become operational by means of a variety of terms, terms that designate, for example, physical characteristics, function, happenings. We attach attributes to the objects and events of reality in the act of constructing meaning. Helping the learner acquire a new term of description is to give him a new concept for receiving, constructing, and expressing meaning.

4. There is an appropriate language, a functional vocabulary for observing/describing and for any process skill.

Any of the skills can be cued and directed by a signal vocabulary, a vocabulary that will cue the mind to carry out the particular skill. There is a vocabulary that designates, for example, the skill of analyzing, a vocabulary that designates the skill of comparing. Further, since mathematics also functions as a formal symbol system, there is also an appropriate mathematics for any process skill. Mathematics can be used to describe, to compare, to speculate.

5. There is no end to the amount of information that can be read or inferred from anything.
6. A limitless number of objective characteristics can be perceived and inferred from a system.
7. The terms and concepts that name or designate physical attributes are inventions. There is no end to how many such concepts can be invented and the extent to which they can be refined and measured.
8. The invention of a new concept or hypothesis results in the invention of new instrumentation and standards of measuring, of ways of recording.
9. Refined instrumentation can open up kinds of information previously unknown or beyond physical perception.
10. Information can be organized and related in many different ways.
11. The same information, organized and classified, represented in different ways can help us to make different and significant conclusions from each mode of organization or representation.
12. Alternate hypotheses, conclusions, generalizations can be inferred from a given body of information.
13. A new idea or hypothesis can open up kinds of data that were previously unknown.
14. Alternate predictions and conclusions can be scientifically evaluated.
15. There are scientific ways for obtaining information related to problems, for solving problems, for making predictions.
16. Any information, scientifically obtained, is relevant to same problem.
17. New information, explanations, conclusions will open up new questions and problems. New questions can lead to new ways of thinking.
18. No description or explanation is complete, cannot be complete.
19. The relevancy of data to a problem can be determined on the basis of influence and effect.

20. A person's mind set determines the kinds of things he will notice, what he will be interested in.

Understanding of the foregoing principles can help the learner be more skillfull with inquiry. For example, the individual can:

- utilize increments of information in order to read more data from a given system.
- utilize a repertory of functional terms of description.
- specify and use language that describes in terms of function, cause, sequence, physical characteristics, etc.
- design a format that can be used in gathering descriptive data.
- utilize terms of description in order to compare, and to interpret information.
- utilize the language of observe/describe in order to construct an analogy.
- utilize various ways of finding out, methods of inquiry and construct an expanding amount of information relating to a particular problem.
- continue to add increments of information to a particular concept, i.e., continue to expand a concept.
- utilize different and appropriate relational schemes.
- organize a given body of information in different ways.
- infer alternate conclusions from a given organization of data.
- utilize a variety of forms of representation.

The individual seeks and produces meaning, primarily for the self. It is only secondarily produced for others. In either case, it may be represented in a variety of ways and at various levels of coherence. The individual wants to learn and needs to learn a variety of ways of representing meaning. There is meaning that is so personalized that it can be expressed only to the self and

only as a kind of vague feeling of meaning. Perhaps it can only be created and expressed to the self. Perhaps it defies coherence. It may be created and expressed best or only by means of music or dance, or painting. Formal symbol systems, such as language and mathematics, or not the only forms for receiving, producing, and expressing meaning. The individual is capable of a spectrum of meaning. Help him find the rainbow.

A Note to Parents

Early in his life the genius of DaVinci was kindled. "Look at the sky, Leonardo, see the animals grazing there. There is a flock of woolley white sheep. They are running before the wind."

"See the bee in the flower. He's covered with lots of yellow flower dust."

"Watch the drop of water as it swells on the leaf. Now it's falling. Quick, watch what's happening. It strikes the water."

"I see, I see; Uncle ____, there's a hole in the water where the drop hit. Big circles are moving out from it. Why does a drop make a hole in the water?"

"I see the birds flying. I want to fly. How do birds fly?" The questing, questioning child was wandering around in the fields and woods surrounding the village of Vinci. He was in the care of his beloved Uncle, a teen-ager. Together they played observing. The child looked. He touched. He listened. He used all his senses learning how to read the book of the surroundings, the natural environment. His sense of wonder was sparked and nurtured. He was developing an intelligent eye, one of the most intelligent ever to look upon the world.

Skill with reading and interpreting surrounding objects and events is the first and foremost task of the learner. It is the learning task of infancy

and early childhood. If the child is fortunate, he will have others who will help him learn to do the reading skillfully.

Try playing observation with the young child. Notice things with him. The parent might help the child notice color. "Here is green. How many things in the room are green? This green is greener than that green. Do you like green? If plants are green, they are alive."

"But the flower, Daddy, is red. I know red."

A word can be used as a kind of lens for observing things. "Moving, how many things are moving? This is moving. That is moving faster." The car is moving. How many cars are moving?" "Today let's play On The. Let's go out into the yard and look with On The. I can see more things on the leaf than you can." "No, you can't". I can see more. There's a bug on the leaf, there's a spot on the leaf. There's a line on the leaf. Now, what do you see under the leaf?"

"Look and see which leaf is bigger. Which leaf is biggest." "Look and see which you like best."

"Have you found a new tomato on the plant? Now that will be your tomato. Each day you must look at it and see if it has changed. Let's see if it changes." "How has it changed? It's getting bigger. It's size is changing. Look, is the color different today? Yes, the color is changing. It's so pretty."

Talk with the child, converse with the child to help him touch and feel, look and see. Use language to help him observe and think about and enjoy the surroundings. Environmental literacy, after all, is the foremost literacy. As the parent finds interest and zest, the child will find interest and zest. It works both ways. The sense of wonder and delight on the part of the child can open up the same sense in an adult. The sense of wonder and appreciation that derives from observing is the foundation for aesthetic sensibility, for the flow of joie de vie. Too, it is the foundation for the questing, questioning interest that fosters mental growth.

FOR THE TEACHER AND PARENT

SOME IDEAS FOR ENHANCING SKILL WITH PRODUCTIVE THINKING

1. On the

   1. Place the card by an example of what the word means.

   2. Tell us what the example is. (5 points)

   Develop a game (utilizing example card) for teaching children the function of "webbers" (prepositions).

2. Through the

   1. Place the card by an example of what the word means.

   2. Tell us what the example is. (7 points)

3. a. Scrutinize anything in the observational field.

   b. Fasten it, shape it, color it, hear it with words.

4. Observe a scene. Frame it with words (say a word frame around it).

   What visible words and phrases (things, occurances) are in the scene? What invisible ones?

5. Observe a scene with the word horizontal. How many things can you string on horizontal?

   Observe scene with green. How many things can you string on green? Develop a chart or (?) to demonstrate your "string."

6. The Grasshopper's Eye

   1. Look very closely at the eye of the grasshopper.

   2. Say a word that makes the eye like your eye. Go on. How many words?

   3. Say a word that makes it different from your eye. Go on. How many?

	Alike	Different
1 word		
2 words		
3 words		

7. a. Observe an object

   b. List 10 words or phrases that make it unlike a nearby object.

   c. List 10 words or phrases that make it like the same nearby object.

8. a. Study (look at, touch, etc.) an old log carefully.

   b. Thinking of it as a life support system.

      1. How many words and phrases can you think of that show "life support system"?

      2. How many verbs of decay

      3. How many nouns?

   c. Study the log as a --

      1. life support system

      2. cause

      3. effect

      4. (Make up your own frame of reference schemes)

9. a. Observe a material object.

   b. Using the questions "What is it?" (It is a ---); "What else is it?" List as many sentences as you can think of that tell what the object is.

   c. Arrange the sentences in order from most general to most specific. Note that the object has expanded relationships each time it is described in more general terms.

10. Leaf Reading

   a. Examine a leaf in terms of shape, form, texture, color, pattern. Read as much information (as many items) as you can about each category, e.g., shape. Try to reason out the significance (the way) of each item about shape, how related to function of the leaf and tree.

   b. Do the same with the other categories, you designated.

11. Capture and Insect

   a. List five words of color, five of form, five of design, five of texture and five of symmetry, etc.

b. Observe from whole to part. Frame the whole insect with words, narrow to a part (e.g., leg). Analyze the engineering of the leg or the eye, etc.

c. How might one aspect (or more) of the insect be related to a problem in the engineering of a building?

d. Relate the structure (or function, etc.) of the insect to five other animals - including the human animal.

12. My Friend, the Tree

a. Observe a tree from a distance. Write words and phrases that describe the tree.

b. Walk under the tree, touch, taste leaves. Smell the tree. Add words and phrases evoked by the additional experiences.

c. Hug the tree, climb the tree, feel its texture. What do you get from each vantage point. Add this information to your description.

d. Name your tree with both a scientific name and a personal name.

e. Assuming a tree perceives and has awareness, how might such perception and awareness differ from the human? What would be the "world of the tree?"

13. Develop your own scheme for observing, describing, organizing, defining, etc. Develop an original paradigm for a lesson design or strategy.

14. 1. Observe and describe a grass plant. Narrow focus. Define veining, texture, shape, form, etc.

2. Remove shoes. Walk on the grass. Smell the grass. Taste a grass shoot. What ideas occur to you? Write them down. Say them. Dance them. Draw them.

3. Study a grass shoot. (color, design, pattern, etc.) List 49 things that it is "like."

4. Grass is beautiful.

15. Reading a Park

1. Define geometry according to an unabridged dictionary.

2. Sketch the geometry of the park. What is where? How do the parts complement the whole? Rearrange and improve the design. What jobs go into the existance of the park?

3. Analyze the material flow, ecology, etc., of the park.

4. List 50 examples (different) of death or dying.

5. How many cyclic systems can you perceive?

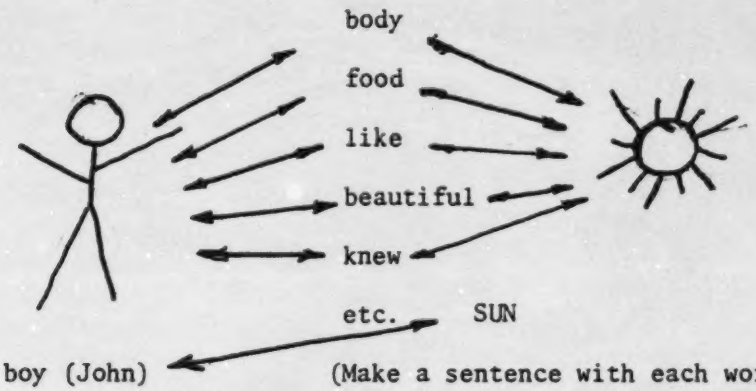
6. Go on - read the park.

16. A word pulls various elements out of the surroundings and unites (synthesizes) the elements into a word unit (concept).

a. List the words (elements) you observe with your concept of weather.

b. List (say) the words you observe with your concept of afternoon.

c.



(Make a sentence with each word and with each sentence relate the boy and the sun.)

18. Evoke (incant) 20 words or phrases that gives Sun a personifying title. Try to have each title symbolize a different meaning. (want to try water or (?)). Design a ritual for each title utilizing a comprehensive approach to expressive meaning (dance, movement, song, poetry, drama, whatever)

19. a. Define: Totemism
animism
anthropomorphism
symbolism
word magic

Develop --

b. Write a brief exemplification of each.

20. Define (in words) mythic meaning according to the following authorities:

Susanne Langer	Rollo May	Plato
Freud	Cassirer	McLuhan

b. According to any one of the authorities, how does mythic meaning relate to other aspects or kinds of meaning or knowing.

21. Write an essay on, "It's Good to be Alive." Develop a word and/or picture collage designed to foster the impression of, "It's Good to be Alive."

22. Construct 10 distinctly different analogies of the human sensory mechanism. Try constructing an analogy by utilizing words of form or color or (?).
For and with each analogy develop a strategy for teaching a selected number of significant principles of perception.

23. Select and observe a material object. What verbs are in it? What nouns (go on with other parts of speech.)
Speculate: What would the observable world be like if it were only noun?--only verb? What is the world of noun? Eyes of noun - of verb, etc.?
- the world of verb?
- the world of adjective?
- the subjunctive world?
What is the most suitable mode for capturing and expressing each of the "worlds?" Why?

24. An operational definition of intelligence: "Intelligence is the ability to perceive, construct, and use relationships."

a. Devise as many relational schemes as you can. Develop a demonstration to illustrate each one.

b. Develop a most simple form (example) of each scheme.

c. Develop a most sophisticated form for each scheme.

25. <u>Cause</u>

List 20 principles that characterize the nature of cause and effect relationships. Exemplify each.

Using content ordinarily associated with anthropology or environmental science or language arts develop cause and effect to fourth grade level pupils.

26. Sequence

Capture 10 sequence chains, each differing in the time variable. Arrange them in order of time lapse. Study and analyze the sequences in relation to the time variable. How many ideas and conclusions can you infer?

27. Sequence

a. The concept of sequence is necessarily implicit in the concept of causality. What else is necessarily implicit in cause? Why?

b. Devise a lesson for teaching each of the concepts in (a) and thus derive an idea about cause.

28. Cause

a. State 10 generalizations, each of which has to do with characterizing the nature of cause and effect relationships, and exemplify each generalization by demonstration.

b. Diagram each generalization as a flow chart using the symbols c for cause, e for effect, and ----> for flow charts.

29. Sequence

a. Observe and define a system. Within the system, how many chains of sequence can you observe and capture in words; capture with a flow diagram; capture in whatever form?

b. Can you locate and capture a reversible sequence?

30. Select (define) a given list of objects or events (process). Point out as many ways of quantifying each as you can think of. Select an object or process. List 5 to 500 objective characteristics of the object.

31. a. Define a material object with words and mathematics. How many subsystems can be defined within the object?

b. Establish causal factors that link the subsystem.

32. Observe a material object. Define it in terms of 10 to 100 different processes of which it is a part.

33. Define a process within a process, within a process, etc. Define a context within a context, within a context, etc.

34. Define 50 areas of negative space. What words can you read from the areas of negative space?

35. Develop a series of concentric concepts by proceeding from most inclusive to least.

36. Systems tie things together

Define the narrowest possible system that you see. Expand focus. Place system within system. How far can you progress outward? What sequence of systems can you build? (from narrow to more inclusive.)

List a series of words that sketch or capture a sub-cycle within an event system.

37. Capture a system as a flat surface. Capture elements of the same system in a three dimensional context (sphere, cube). Compare the meaning of the two. How many different types of relationships can be used to "web the system"?

38. a. Study an area. Limit to a square foot, yard, inch. What visible word (ideas) can you read from the area? What invisible ones? Why the visibility? Why the invisibility?

b. Read the area (or system) with the concept of triangle, twoness, sizes or/and, how many concepts can you read the area with?

39. At random select an object or an event. Construct 50 contexts (systems) of which it could be a part. Have fun.

40. a. Link up a series of contiguous systems. What mutual relationships can you discover in and among the systems?

b. Develop a workable definition for a physical (phenomenal) system. What kinds of systems are there other than physical systems? How are they like or different from physical systems?

41. Capture a system by using only one word; color, shape, form, occurance, number, function, etc. Narrow to a material object.
    a. Capture it as centrally located in a system.
    b. Capture it as peripherally located in a system.
42. Capture a system in terms of what is. Shift time. How many additional factors are brought in by building the "world of what was," -- "what will be, "what ought to be," "what may be," etc. Use an object or system along with "time shift" to demonstrate a cyclic relationship.
43. Examine and Imagine
    a. What is the life space of a lizard? A tree? -- whatever? How are the life functions of a specific living thing fulfilled?
    b. Select 51 objects or systems. Describe each in terms of the temporal.
    c. Describe the living odor of a tree, of a person, of a mushroom, or a stream, of a rock, of the air.

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